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Correlates of health-related quality of life, psychological well-being, and eating self-regulation after successful weight loss maintenance

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Abstract The purpose of this study was to evaluate health-related quality of life and other psychosocial characteristics, including eating self-regulation and body image, in a group of successful long-term weight loss maintainers. Women enrolled in the Portuguese Weight Control Registry ($n = 107$) were matched and compared to women at the end of a behavior weight loss treatment program ($n = 107$), and also with women in the community who were not trying to lose weight ($n = 107$). Successful maintainers displayed higher quality of life and a more positive profile in selected eating and exercise markers of self-regulation compared to similarly-weighted women not attempting weight loss, but not when compared to the 'weight loss treatment' group. However, results also suggest that concerns with body shape and size may persist after weight loss and that some aspects of well-being and eating self-regulation can be more successfully targeted in specific weight loss programs.

Keywords Quality of life · Well-being ·
Eating self-regulation · Weight loss maintenance ·
Obesity · Overweight women

Introduction

Obesity has become one of the most important public health problems of this century. Obesity negatively affects

quality of life (Wyatt et al., 2006), and may contribute to higher rates of anxiety, depression, and low self-esteem (Dallman et al., 2003; Kottke et al., 2003) due to social values and norms that promote social stigma against obese individuals. Failure to maintain initial weight loss over the long-term is common in obesity treatment (Jeffery et al., 2000). Still, about 20 % of overweight individuals who try to lose weight are successful in the long run (Wing & Phelan, 2005). Research from the National Weight Control Registry, an ongoing longitudinal study of US adults who have lost more than 30 lb (13.6 kg) and kept this weight loss off for at least one year (Klem et al., 1997) showed that losing a substantial amount of weight and successfully maintaining that weight loss is possible. In fact, the first year of maintaining weight loss maintenance may be the hardest: Individuals succeeding in maintaining their weight loss for two or more years increase the odds by more than 50 % of achieving their goal in the long term (McGuire et al., 1999).

Early investigations pointed out that maintaining long-term weight loss could be associated with an increased risk of eating disorders or depression symptomatology (Keys et al., 1950; Stunkard & Rush, 1974; Weiss & Ebert, 1983). However, more recent studies found little support for this assumption (Klem et al., 1998) and concluded that no adverse psychological effects of weight loss have been observed in successful weight loss maintainers. On the contrary, the majority of these individuals (over 90 %) reported improvements in their overall quality of life, level of energy, mobility, general mood, and self-confidence (Klem et al., 1997). Participants in the Swedish Obese Subjects study also reported improvements in several domains of health-related quality of life, two years after weight loss surgery (Karlsson et al., 1998). Moreover, weight loss achieved through diet and exercise interventions is frequently associated with improvements in quality

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of life (Rippe et al., 1998) which, in turn, may be predictive of weight loss maintenance in the long run. Findings from a behavioral treatment program with 142 overweight/obese women showed that there might be a positive role of short-term changes in body size dissatisfaction and self-esteem on long-term weight loss (Palmeira et al., 2010). In part, this could be due to improvements in eating behavior, since body image has been shown to predict eating self-regulation during obesity treatment (Carraça et al., 2011).

Studies that compared weight loss maintainers with other groups showed that successful weight loss maintainers engage in more physical activity and self-monitoring and consume a lower-fat diet than obese control participants (Kayman et al., 1990; Ogden, 2000). They also reported being more likely to use direct coping and less likely to seek help when compared with unsuccessful maintainers (Dohm et al., 2001). A recent study showed that weight loss maintainers had higher levels of dietary restraint and physical activity as well as lower levels of dietary disinhibition and TV viewing than treatment-seeking obese persons (Phelan et al., 2009).

Among other variables, eating disinhibition, cognitive restraint, and perceived hunger are commonly used constructs for the evaluation of eating self-regulation in the context of obesity and weight control (Carraça et al., 2011; Elfhag & Rossner, 2005; Teixeira et al., 2005). Eating disinhibition is associated with a higher body mass index, less healthful food choices, lower self-esteem, low physical activity and poor psychological health (Bryant et al., 2008). Increases in eating self-efficacy and cognitive restraint, and decreases in emotional eating and eating disinhibition have consistently been demonstrated to predict successful weight control (Foster et al., 1998; Linde et al., 2006; Teixeira et al., 2006). In a study with participants of the National Weight Control Registry, eating disinhibition in response to internal cues, such as feelings and thoughts, was associated with poorer long-term weight loss outcomes (Niemeier et al., 2007). Adopting flexible cognitive restraint predicts long-term weight loss success (Riesco et al., 2009; Teixeira et al., 2010) and has been suggested as a possible mechanism by which physical activity contributes to successful weight management in women (Andrade et al., 2010). Also, increased general self-determination and exercise motivation seem to produce a positive impact on eating self-regulation (Mata et al., 2009). Furthermore, exercise autonomous motivation was positively correlated with health-related quality of life (Vieira et al., 2011) and psychological well-being was associated with enjoyment and intrinsic motivation for exercise (Ekkekakis & Lind, 2006). Finally, a randomized controlled trial showed that higher doses of exercise were associated with larger improvements in mental and physical aspects of quality of life, independently of weight change (Martin et al., 2009).

In the current study, we sought to explore weight loss maintainers' quality of life, psychological well-being, and eating self-regulation. For that purpose, a group of similarly-weighted women not trying to lose weight was chosen as an initial comparison group to test whether having gone through a process of weight loss followed by maintenance might bring individuals to a level of psychological well-being and eating behaviors similar to people in the general population who are not concerned with weight loss. Secondly, we wanted to isolate weight maintenance from the process of weight loss and test whether there might be positive psychological and behavioral changes taking place after weight loss as a consequence of weight stabilization. For this purpose, a similarly-weighted group was chosen that was also interested in losing weight but had done so recently (presumably too recently to have achieved weight maintenance). Finally, we also examined exercise-related correlates of quality of life, psychological well-being, and eating self-regulation in the group of successful weight loss maintainers.

We hypothesized that in comparison to women not trying to lose weight, weight loss maintainers would show a comparable level of health-related quality of life and psychological well-being. Second, in comparison to participants who were still in the weight loss phase and thus had not yet achieved weight loss maintenance, weight loss maintainers would show higher health-related quality of life, psychological well-being, and eating self-regulation. Finally, within the group of weight loss maintainers, we expected that markers of exercise intrinsic motivation and physical activity level would be positively correlated, and sedentary behavior would be negatively associated, with health-related quality of life and psychological well-being. Regarding eating self-regulation, we expected that higher levels of physical activity and exercise motivation would correlate positively with improved eating self-regulation, expressed by lower eating disinhibition and more flexible cognitive restraint.

Methods

Participants

Participants were drawn from three separate samples: maintaining weight loss after having lost weight on their own; they were currently enrolled in weight loss treatment; or they were recruited from the community at large and were not seeking weight loss. Further details on these three groups are given below and sample characteristics are presented in Table 1. We started with the *weight loss maintainers* group (largest sample available at the present

time) and then formed the other two groups from two larger pool of participants, with the same sample size and matched for age, weight, BMI and obesity level, and college education. There was no compensation of any kind and all participants followed the predefined assessment protocol. About 98 % of women were caucasians, the remaining were black.

All women in the *weight loss maintainers* group ($n = 107$) are participants in the Portuguese Weight Control Registry, which is an ongoing program that started in 2008. The goal of this registry is to identify individuals, aged between 18 and 65 years, who intentionally lost at least 5 kg of weight in the last 15 years of their adult lives and kept the weight off for at least 1 year. Individuals with a BMI lower than 18.5 kg/m² (after weight loss) are not accepted. Recruitment strategies include a study website and national advertisement in hospitals, primary health care centers, pharmacies; as well as announcements on TV, radio, and in newspapers. Women in the *weight loss treatment* group ($n = 107$) were older than 24 years, premenopausal, not pregnant, and had just finished a 12-month behavioral weight loss program, targeting improvements in physical activity, dietary habits, body image, and weight control self-regulation (Silva et al., 2008). Data used in the present study were collected between 2006 and 2008. Participants in these two studies signed a consent form prior to participation, in which aims of these two studies, procedures, risks and benefits were described. The Faculty of Human Kinetics' Ethics Committee reviewed and approved both studies. In the group *not attempting weight loss* ($n = 107$), women had to be over 18 years old, not enrolled in a formal weight loss treatment program, and stated that they were not presently attempting to lose weight. They were recruited in multiple contexts such as schools, worksites, and health/medical centers through flyers, newsletters, and through listservs and mass emails. Data were collected in 2007.

Measures

For the *weight loss maintainers* and *weight loss treatment* groups, data were collected during one laboratory session (they were part of the original study protocol) while for the group *not attempting weight loss* data were collected at the location of recruitment. Instruments were validated Portuguese versions of some of the most commonly used psychosocial instruments in obesity research; they are described in detail below, including Cronbach's alphas for the present data set. Participants completed psychosocial assessments following a standardized protocol and with a study technician in attendance. Forward and backward translations between English and Portuguese were performed for all questionnaires. Two bilingual Portuguese researchers subsequently reviewed the translated Portuguese versions, and minor adjustments were made to improve grammar and readability.

Health/weight-related quality of life

To measure general health-related quality of life participants completed the Short-Form Health Survey (SF-36) questionnaire (Ferreira, 2000; Ware et al., 1993; Ware & Kosinski, 2001), with a total of 36 items composed of eight dimensions: Physical functioning (Cronbach's $\alpha = .83$), physical role limitations (Cronbach's $\alpha = .89$), bodily pain (Cronbach's $\alpha = .88$), general health (Cronbach's $\alpha = .82$), emotional role limitations (Cronbach's $\alpha = .74$), social functioning (Cronbach's $\alpha = .71$), vitality (Cronbach's $\alpha = .86$), and mental health (Cronbach's $\alpha = .90$). These dimension scores are summarized into two scales, representing physical (physical component summary) and psychological (mental component summary) composite values. Statements such as "During the past 4 weeks, I cut down the amount of time I spent on work or other activities" are answered with *yes* or *no*; questions such as "How much bodily pain have you had during the past 4 weeks?"

Table 1 Sample characteristics

	Weight loss maintainers ($n = 107$) Mean \pm SD	Weight loss treatment ($n = 107$) Mean \pm SD	Not attempting weight loss ($n = 107$) Mean \pm SD	p
Age (years)	38.5 \pm 7.9	38.6 \pm 6.4	38.0 \pm 7.3	0.842
Weight (kg)	69.0 \pm 11.6	68.7 \pm 9.4	69.3 \pm 11.4	0.732
BMI (kg/m ²)	26.0 \pm 4.0	26.3 \pm 3.6	26.0 \pm 3.9	0.545
Normal weight (%)	43.4	42.4	43.5	
Overweight (%)	38.2	40.2	39.2	0.952
Obese (%)	18.4	17.6	17.3	
College education (%)	66.4	66.3	65.5	0.103

BMI body mass index, SD standard deviation, p p value for ANOVA comparing all groups for age, weight, and BMI; p p value for Pearson Chi-square comparing all groups for obesity level and college education

are evaluated on a 6-point Likert scale from *none* to *very severe*. Higher scores indicate better health-related quality of life.

Weight-related quality of life was also assessed using the Impact of Weight on Quality of Life—Lite (Engel et al., 2005; Kolotkin et al., 2001), a 31-item questionnaire consisting of five subscales: Physical function (e.g. “Because of my weight, I have difficulty getting up from stairs”, Cronbach’s $\alpha = .89$) self-esteem (e.g. “Because of my weight, I don’t like myself”, Cronbach’s $\alpha = .88$), sexual life (e.g. “Because of my weight, I have little or no sexual desire”, Cronbach’s $\alpha = .87$), public distress (e.g. “Because of my weight, I worry about finding chairs that are strong enough to hold my weight”, Cronbach’s $\alpha = .87$), and work (e.g. “Because of my weight, I have trouble getting things accomplished or meeting my responsibilities”, Cronbach’s $\alpha = .88$). These sub-scales can be summarized into a total score (Cronbach’s $\alpha = .88$). Items are answered using a 5-point Likert scale from *never true* to *always true* and higher scores indicate better weight-related quality of life.

Psychological well-being

Self-esteem was assessed with the Rosenberg Self-Concept/Self-Esteem Scale (Azevedo & Faria, 2004; Rosenberg, 1965), composed of 10 items such as “I feel I do not have much to be proud of” or “I feel that I have a number of good qualities”, evaluated on a 4-point Likert scale from *strongly agree* to *strongly disagree* (Cronbach’s $\alpha = .88$). Higher scores of the Rosenberg Self-Concept/Self-Esteem Scale represent greater self-esteem.

Body image dissatisfaction was measured with the Body Image Assessment questionnaire (Williamson et al., 1989), which consists of nine silhouettes of increasing size. Participants are asked to choose their current (i.e., perceived actual body size) and ideal figures. The difference between the actual and ideal body size is an indicator of body image dissatisfaction (Cronbach’s $\alpha = .74$), and addresses the evaluative dimension of body image. Higher scores represent higher body image dissatisfaction.

The Body Shape Questionnaire (Cooper et al., 1987), a 34-item instrument (e.g., “Has being with thin women made you feel self-conscious about your shape?”; “Has being naked, such as when taking a bath, made you feel fat?”), was applied to measure the experience of, and preoccupation with *being fat* (Cronbach’s $\alpha = .97$), addressing the investment dimension of body image (i.e., the cognitive-behavioral importance of one’s appearance) (Cash et al., 2004). Higher values indicate greater body shape concerns and poorer body image.

Eating self-regulation

The Eating Inventory (Stunkard & Messick, 1985) is a 51-item questionnaire, also known as the Three-Factor Eating Questionnaire, and was used to assess levels of cognitive restraint (Cronbach’s $\alpha = .77$), disinhibition (Cronbach’s $\alpha = .75$) and perceived hunger (Cronbach’s $\alpha = .76$). The cognitive restraint scale (21 items) measures conscious attempts to monitor and regulate food intake, the disinhibition scale (16 items) measures uncontrolled eating in response to cognitive or emotional cues, and the perceived hunger scale (14 items) measures the extent to which respondents experience feelings of hunger in their daily lives. Higher scores indicate higher levels of cognitive restraint, disinhibition, and perceived hunger. For the purpose of this study, disinhibition and perceived hunger scales were used, along with two additional scores, flexible restraint and rigid restraint (Westenhoefer, 1991; Westenhoefer et al., 1999): Flexible cognitive restraint (seven items) is associated with low emotional and disinhibited eating, with a higher score indicating a more graduated approach to eating and weight control. Rigid cognitive restraint (seven items) is associated with a dichotomous, all-or-nothing eating pattern and with higher disinhibition.

Exercise motivation

Exercise motivation was assessed with a version of the Intrinsic Motivation Inventory (McAuley et al., 1989) adapted to specifically measure an individual’s level of motivation for exercise and physical activity in the dimensions of interest/enjoyment (e.g., “I enjoy getting involved in physical activities very much”, Cronbach’s $\alpha = .84$) and perceived competence (e.g., “I think I do pretty well at physical activities, compared to others”, Cronbach’s $\alpha = .79$), each with four items, with higher scores indicating a more internal, self-regulated type of motivation.

Physical activity and sedentary behaviors

To measure sedentary behaviors, all women in the Portuguese Weight Control Registry reported sitting time, including time spent watching television, working or playing at a computer, and working at a desk, on a weekday and on a weekend day. Energy expenditure and time spent being physically active were assessed with the Seven-day Physical Activity Recall, a structured interview that uses time-of-day cues such as meal times to determine minutes spent in physical activity over the course of an average week (Sallis et al., 1985). Previous studies have supported the reliability and validity of the Seven-day Physical

Activity Recall as a measure of physical activity (Conway et al., 2002; Leenders et al., 2001; Washburn et al., 2003). For the current study, activity reports were collapsed into total minutes of moderate or vigorous intensity physical activity in a week (all activities above 3 METs, Metabolic Equivalent of Task, were considered).

Body habitus

For women in the *weight loss maintainers* and *weight loss treatment* groups, body weight was measured twice with an electronic scale (SECA model 770, Hamburg, Germany) and the average of the two measures was used; participants were wearing light clothes and no shoes (Lohman et al., 1991). Height was measured twice and the average of the two values was used for analyses. For women in the *not attempting weight loss* group, weight and height were self-reported. BMI was calculated for all women.

Statistical analyses

Statistical analyses were completed using the Statistical Package for the Social Sciences version 19. Measures of central tendency and distribution were examined for health/weight-related quality of life and psychosocial variables. Group comparisons between *weight loss maintainers* and the other two groups were determined running *t* tests analysis. Pearson correlations were used to test associations among all study variables considering only the *weight loss maintainers* group, and partial correlations to adjust for moderate or vigorous physical activity. Type 1 error was set at $\alpha = .05$ (two-tailed) for all tests.

Results

Sample characteristics by weight loss status group are presented in Table 1. The three groups were matched for age, weight, BMI and obesity level, and college education. Hence, as expected, there were no differences ($p > .05$) among groups. Women in the *weight loss maintainers* group lost an average of 14.7 kg, corresponding to a loss of 17 % of initial body weight, and kept their weight off for 2.5 years. In the treatment group, women had lost an average of 6.1 kg or 8 % of initial body weight at the end of the behavioral program.

We compared the three groups for health-related and weight-related quality of life, psychological well-being, eating self-regulation, and also exercise interest/enjoyment and perceived competence. Table 2 summarizes results for *t* tests comparisons and includes effect sizes between *weight loss maintainers* group and each of the other two groups. Compared with the *weight loss treatment* group,

successful maintainers reported significantly lower physical health quality of life and higher body shape concerns, eating disinhibition, and perceived hunger. Between these two groups, the largest effect sizes ($>.50$) were observed for physical health quality of life and body shape concerns. Compared to the group *not attempting weight loss*, weight loss maintainers showed higher physical health quality of life, lower disinhibition and perceived hunger, and higher exercise interest/enjoyment and perceived competence, but higher body image dissatisfaction and body shape concerns. In this comparison, very large effect sizes was observed for body shape concerns, eating disinhibition, and perceived hunger ($>.80$) and medium effect sizes observed for the remaining comparisons.

Next, and considering only the *weight loss maintainers* group, we tested associations between exercise-related variables, including exercise interest/enjoyment, exercise perceived competence, time spent weekly with physical activity and sedentary behavior, and health/weight-related quality of life, psychological well-being, and eating self-regulation (Table 3). These women reported engaging in an average of 311 ± 198 min per week of moderate or vigorous physical activity and spent an average of 5.2 ± 2.5 h per day watching TV, working on a computer or sitting at a desk.

In the group of women who have successfully lost weight, moderate or vigorous physical activity was positively correlated with rigid cognitive restraint. Exercise interest/enjoyment was positively associated with self-esteem and negatively associated with body shape concerns, and exercise perceived competence positively correlated with physical health quality of life. After adjusting for moderate or vigorous physical activity, exercise interest/enjoyment was no longer significantly correlated with self-esteem and exercise perceived competence was no longer associated with physical health quality of life. All significant bivariate correlations are small in magnitude, except for the association between rigid cognitive restraint and physical activity, which are of medium size.

Discussion

The goals of this study were (a) to compare quality of life, psychological well-being, and eating self-regulation between weight loss maintainers and both treatment seekers and women not attempting weight loss, and (b) to test exercise-related variables as correlates of quality of life, psychological well-being, and eating self-regulation in the case of successful weight loss maintenance. To briefly summarize our findings, successful maintainers reported significantly lower physical health quality of life and increased body shape concerns, increased eating disinhi-

Table 2 Health-related quality of life, psychological well-being, and eating self-regulation by weight loss status group

	Weight loss maintainers (<i>n</i> = 107)	Weight loss treatment (<i>n</i> = 107)	Not attempting weight loss (<i>n</i> = 107)	Weight loss maintainers versus weight loss treatment Effect size	Weight loss maintainers versus not attempting weight loss Effect size
	Mean ± SD	Mean ± SD	Mean ± SD		
Physical health quality of life	55.1 ± 6.8	58.3 ± 5.5	52.2 ± 6.8	−0.52***	0.43**
Mental health quality of life	46.2 ± 11.1	44.2 ± 11.8	47.3 ± 9.9	0.17	−0.10
Weight-related quality of life	87.7 ± 14.4	90.4 ± 9.9	85.0 ± 15.3	−0.22	0.18
Self-esteem	33.2 ± 5.1	34.1 ± 5.0	33.8 ± 4.3	−0.18	−0.13
Body image dissatisfaction	1.30 ± 1.0	1.31 ± 0.6	0.96 ± 0.9	−0.01	0.36*
Body shape concerns	83.5 ± 35.7	68.0 ± 19.7	59.0 ± 19.3	0.56***	0.89***
Flexible cognitive restraint	5.7 ± 1.3	5.9 ± 1.2	5.8 ± 0.7	−0.16	−0.10
Rigid cognitive restraint	4.9 ± 1.7	4.9 ± 1.5	4.8 ± 1.1	0.00	0.07
Eating disinhibition	7.2 ± 3.9	6.3 ± 3.4	10.2 ± 0.8	0.25*	−1.28***
Perceived hunger	5.1 ± 3.3	4.2 ± 2.6	11.9 ± 1.0	0.31*	−3.16***
Exercise interest/enjoyment	4.16 ± 0.7	4.21 ± 0.7	3.96 ± 0.7	−0.07	0.29***
Exercise perceived competence	3.70 ± 0.7	3.81 ± 0.7	3.37 ± 0.7	−0.16	0.47***

SD standard deviation

* *p* < 0.05; ** *p* < 0.01; *** *p* < 0.001, *p* value for *t* test comparing weight loss maintainers' group with weight loss treatment's group, and weight loss maintainers' group with not attempting weight loss' group; Cohen's *d* effect size reported

Table 3 Exercise variables correlation with health-related quality of life, psychological well-being, and eating self-regulation

	<i>n</i> = 107					
	Exercise interest/enjoyment		Exercise perceived competence		Moderate and vigorous physical activity (min/week)	Sitting time (h/day)
	<i>r</i>	<i>r</i> partial	<i>r</i>	<i>r</i> partial	<i>r</i>	<i>r</i>
Physical health quality of life	0.12	0.10	0.25*	0.21 [#]	0.07	−0.18 [#]
Mental health quality of life	0.10	0.08	0.02	0.02	0.13	−0.17
Weight-related quality of life	0.17	0.15	0.15	0.14	0.13	−0.15
Self-esteem	0.24*	0.21 [#]	0.18	0.14	0.19 [#]	−0.06
Body image dissatisfaction	−0.06	−0.08	−0.12	−0.13	−0.07	0.07
Body shape concerns	−0.25*	−0.23*	−0.06	−0.08	−0.01	−0.11
Flexible cognitive restraint	0.10	0.04	0.19 [#]	0.10	0.19 [#]	−0.01
Rigid cognitive restraint	0.14	0.04	0.20 [#]	0.08	0.33***	−0.09
Eating disinhibition	−0.09	−0.12	0.07	0.06	−0.01	−0.05
Perceived hunger	−0.10	−0.13	−0.03	−0.03	−0.01	−0.03

r Pearson's correlation coefficient. [#] *p* < 0.10; * *p* < 0.05; ** *p* < 0.01; *r* partial: partial correlation coefficient adjusting for moderate or vigorous physical activity

bition, and increased perceived hunger than women participating in behavioral obesity treatment. However, compared with women not attempting weight loss, successful weight loss maintainers showed higher physical health quality of life, lower disinhibition and perceived hunger, and higher exercise interest/enjoyment and perceived competence. They also displayed higher body image dissatisfaction and increased body shape concerns. Considering only the group of successful weight loss maintainers, exercise perceived competence was associated with physical health quality of life, while exercise interest/enjoyment (intrinsic motivation) correlated with higher self-esteem and lower body shape concerns (in this case independent of actual exercise level). Time spent in moderate or vigorous

physical activity was associated with rigid cognitive restraint.

Contrary to our hypothesis, successful weight loss maintainers showed reduced physical health quality of life, body image, and eating self-regulation in comparison with women who participated in a behavioral obesity treatment and were matched for age and weight. An explanation for our findings could be the characteristics of this particular treatment program, which was designed to not only result in weight loss, but also to promote physical activity and well-being as intervention targets per se. Intervention topics included (but were not limited to) management strategies for emotional and external eating, improving body acceptance and body image, establishing a supportive

climate for all participants, and allowing autonomous decisions (Silva et al., 2008). On the other hand, successful weight loss maintainers (i.e., participants in the Portuguese National Weight Control Registry) reported a high variability in weight loss methods. The majority of these women lost weight on their own, with a small number of treatment seekers and in this case mostly seeking individual treatment (Vieira et al., in submission). Differences in the way weight loss maintainers and weight loss treatment women lost weight may have influenced health/weight-related quality of life, psychological well-being, and eating self-regulation. In addition, women who just finished losing weight may have a more acute perception of the positive impact that weight loss has on daily activities, especially in physical tasks, compared to weight loss maintainers who had already experienced several years of weight maintenance including some weight regain. In fact, despite the large average weight losses reported by the Registry participants, criteria to enter this study is limited to having lost at least 5 kg and having maintained it (5 kg) for at least 1 year; this does not preclude some participants from having lost more than the minimum amount as long as they were able to maintain a loss of 5 kg after 1 year (i.e., they may have regained some of the weight they initially lost).

Research from the National Weight Control Registry in the US concluded that there are no adverse psychological effects of weight loss in successful losers when they were compared with different community samples (Klem et al., 1998). Our study partially replicates these findings. In fact, no differences were found between successful weight loss maintainers and women who are not attempting weight loss for mental health quality of life, weight-related quality of life, and self-esteem. Moreover, weight loss maintainers showed higher physical health quality of life and increased eating self-regulation than women not attempting weight loss, with lower eating disinhibition and perceived hunger. Exercise may in part explain these results, since these successful weight loss maintainers reported a high level of physical activity, above recommended guidelines for preventing weight gain, which point to moderate-intensity physical activity between 150 and 250 min per week and more than 250 min per week for weight maintenance (Donnelly et al., 2009). In a randomized controlled trial with 430 overweight or obese sedentary women, higher doses of exercise were associated with health-related quality of life, independently of weight change (Martin et al., 2009) and exercise and physical activity have been associated with improvements in eating self-regulation (Andrade et al., 2010). Additionally, Mata et al. (2009) found that exercise motivation was associated with better eating self-regulation (Mata et al., 2009) highlighting motivational factors as one of several mechanisms that may underlie the complex

relationship between exercise and eating behaviors (Joseph et al., 2011).

Importantly, successful weight loss maintainers showed impaired body image in comparison to women not attempting weight loss. In addition, when they were compared to women undergoing behavioral obesity treatment, weight loss maintainers reported equal levels of body self-ideal discrepancy (a measure of evaluative component of body image, indicating the figure women believed represented their current and ideal body size) but higher levels of concern with body shape and size, a measure that denotes a stronger emotional investment in one's body features and reflecting an over-preoccupation with weight and shape, their antecedents and consequences, and also an overconcern for how others judge our appearance and the subsequent social impairment (Cash et al., 2004). Overweight and obesity may have a negative impact on body image (Cash & Pruzinsky, 2002; Cooper et al., 2003), especially among those seeking treatment (often with the goal to improve these sorts of variables) (Sarwer et al., 1998). In fact, feeling good with themselves could be the reason for women in the group *not attempting weight loss* to not seek treatment, which would explain the body image results, despite their weight. Also, the way women in the *weight loss maintainers* group lost their weight could negatively predict body image. It is possible that these successful maintainers based their weight loss efforts on improving body image and reducing body shape concerns, but were only partially successful. Stice and Shaw (2002) theorized on these possible influences, illustrating the role of body dissatisfaction on the development of maladaptive eating behaviors. For example, body dissatisfaction reductions might counteract extreme dieting patterns and negative affect that could arise (Stice & Shaw, 2002).

The hypothesis that exercise perceived competence and exercise enjoyment, both measures associated with exercise intrinsic motivation, would positively correlate with measures of psychological well-being was only partially supported; physical health quality of life, body image, and self-esteem were predicted by one of these measures (and not consistently after adjustment for self-reported physical activity). Generally, intrinsic motivation and perceived competence are expected to predict more autonomous and well-internalized forms of motivation which in turn should be associated with improved psychological functioning across multiple life domains (Deci & Ryan, 2008). For instance, in a recent article, we observed that exercise autonomous motivation was positively correlated with physical and mental health quality of life and with weight-related quality of life as well (Vieira et al., 2011). By not measuring other indicators of autonomous motivation such as identified and integrated forms of behavior regulation, the present study may have failed to fully capture important

elements of the level of internalization around the regulation of exercise behavior. Nevertheless, the associations between intrinsic motivation and self-esteem and in particular body shape concerns—an important marker of dysfunctional investment in one's body image especially among the obese (Carraça et al., 2010)—are noteworthy and point to specific ways in which psychological well-being can be promoted (or preserved) during and especially after weight loss. Not only does evidence support the role of self-determined motivation to promote initial and long-term exercise adherence (Hagger & Chatzisarantis, 2007; Silva et al., 2011), but it may also predict important psychological outcomes during weight loss maintenance. Ways by which autonomous and intrinsic motivation can be promoted include providing the opportunity to make choices about one's exercise program, discussing the rationale for exercise-related goals, limiting the use of pressure, deadlines, and other external forms of control, creating optimal challenging contexts, and providing a warm and accepting interpersonal climate (Edmunds et al., 2009).

Finally, moderate or vigorous exercise was positively associated with rigid cognitive eating restraint, a variable which is typically indicative of a dichotomous, all-or-nothing eating pattern (e.g., allowed/forbidden foods, *good/bad* eating days, etc.) and associated with higher disinhibition; this trait tends to increase the risk of weight regain and does not promote psychological well-being (Bryant et al., 2008; Byrne et al., 2003). Based on other studies showing that flexible restraint was a stronger predictor of long-term weight control than rigid restraint (Riesco et al., 2009; Teixeira et al., 2010), this finding was unexpected. It appears that these successful maintainers may to some degree adopt strict weight control behaviors, a pattern also suggested by their very high levels of self-reported exercise. Although they may have found a form of self-regulation that works for them in so far as maintaining their weight loss, our results suggest that this pattern could potentially compromise some psychological variables.

One limitation of this study is that the group *not attempting weight loss* self-reported their weight and height. Although obese individuals are more likely to under-report their weight and over-report their height than are individuals who are not obese (Ford et al., 2001), some other studies suggest that self-reported weight is highly correlated with scale weight (Fitzgibbon et al., 1993). It should be noted that the present samples, composed of community volunteers, were not randomly selected for each of the groups and consequently differences in other unmeasured variables could contribute to partially explain the present results, which is a limitation. Another limitation is that *weight loss maintainers* group was self-selected, thus generalization is limited and it is unclear whether

findings would differ in more diverse samples of successful losers. Type of behavioral treatment program is also a limitation to findings generalization. It is possible that participants in this particular weight loss treatment showed better results compared to other obesity treatment programs due to the duration and intensity of treatment (30 sessions in total), and because it was a group treatment. Previous reports from this study showed significant improvements in body image and eating self-regulation (Teixeira et al., 2010). Lastly, we did not adjust for the type of weight loss method used by participants in the *weight loss maintainers* group.

In sum, this study found that women who maintain their weight loss in the long-term have some aspects of their quality of life and eating self-regulation improved when compared to similarly-weighted women who are not trying to lose weight. However, body image concerns appear resistant to weight loss and these long-term weight loss maintainers showed a poorer psychological profile than participants who underwent behavioral weight loss treatment. During weight loss maintenance, higher levels of intrinsic motivation toward exercise, such as feeling increased competence or self-efficacy and reporting more interest and enjoyment, may play a role in preserving psychological well-being. Health professionals might want to take this into account when prescribing exercise in the context of weight control, particularly at a time when exercise is often viewed as a mere means to the end of weight loss.

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